

# Parts of a Computer

## Info Pro 10

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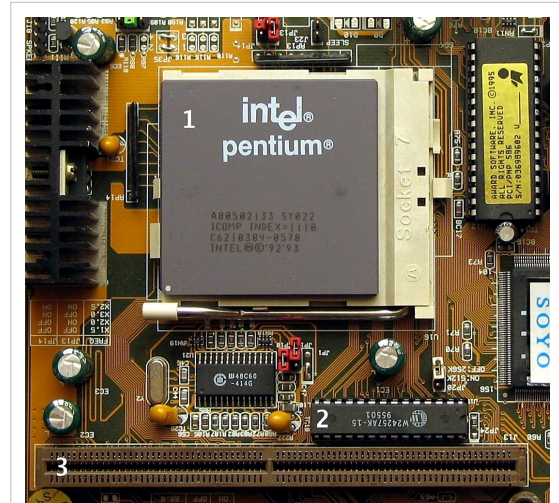
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# Central processing unit

A **central processing unit (CPU)** is an important part of every computer. The CPU sends signals to control the other parts of the computer, almost like how a brain controls a body.

The CPU is an electronic machine that works on a list of things to do, called 'instructions'. It reads the list of instructions, one instruction at a time, and does each one in order. A list of instructions that a CPU can read is a computer program. A machine that can perform the job of a CPU is often called a Turing machine by mathematicians.

The speed that a CPU works at is measured in "Hertz", Hz, however modern processors run so fast that "Gigahertz", "GHz", is used. One gigahertz is one billion hertz.



A Pentium CPU inside a computer

## Functionality

Here are some of the basic things a CPU can do:

- Add two numbers together
- Test to see if one number is larger than another
- Move a number from one place to another
- Get a number from memory
- Jump to another place in the instruction list

Even very complicated programs can be made by combining many simple instructions like these. This is possible because each instruction takes a very small time to happen. Many CPUs today can do more than 1 billion instructions in a single second. In general, the more a CPU can do in a given time, the faster it is. One way to measure a processor's speed is MIPS. Flops and CPU clock speed (usually measured in gigahertz) are also ways to measure how much work a processor can do in a certain time.

A CPU is built out of logic gates; it has no moving parts. The CPU of a computer is connected electronically to other parts of the computer, like the video card, or the BIOS. A computer program can control these peripherals by reading or writing numbers to special places in the computer's memory.

## Multiple Cores

Some newer processors have "Multiple Cores". This means that they have many processors built on to the same chip so that they can do more than one thing at once.

While the individual cores might be slower than a single core processor, all the cores can work together to go faster. This means that the GHz might be lower, however the overall speed of the processor will be higher.

To make an analogy, think of cars;

- One car travelling at 100 miles per hour for an hour, will cover 100 miles.
- Four cars travelling at 70 miles per hour for an hour will cover only 70 miles each, but together they will cover a total of 280 miles.

## Further Information

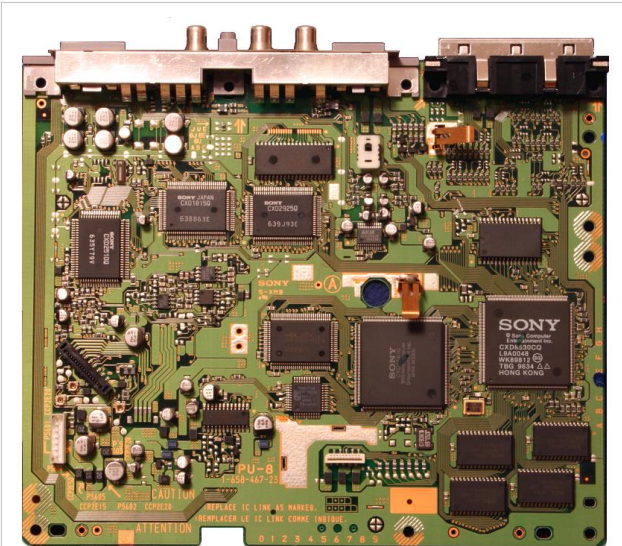
- Microprocessor
- Intel
- AMD

# Motherboard

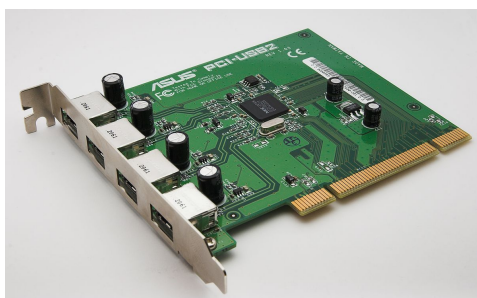
The **motherboard** or **mainboard** is the main circuit board in a complex electronic system, like a computer. It is the most 'central' part of a computer. All of the different parts of the computer are connected to the motherboard. This lets them work together. In most computers, the motherboard is a big green board, but many come in different colors like black, red and yellow.

## "On-board" and "plug-in" parts

Normal electrical parts must be kept on the motherboard. These "on-board" parts include transistors and resistors. Many of the major parts that are attached to the board are able to be removed in the future so that they can be upgraded. The CPU and memory (or RAM) are examples of parts that are usually removable.



The mainboard of a Sony Playstation



Ports on an expansion card

Parts that are not "on-board" can be bought as a card. In fact, many of the on-board parts on today's computers were at one time an expansion card that became very popular. These were put on the board to free up the card slots for other things. Computers today usually have a memory port, 2 or more USB ports, a parallel port (for use with old printers usually), audio & microphone jacks, a network port and ports for the keyboard and mouse. There are also rare motherboards that have plugs only for very specific parts.

All of the slots and plugs both inside and outside the computer case are shaped a certain way to accept a certain type of part.

Some will not even accept parts even one generation behind, such as the CPU and memory. Others, like the video plug have not changed in years. Some of the plugs, such as the video, keyboard and mouse plugs, are a special color. These colors make it easier to pair the plug to the port.

# Computer memory

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The **computer memory** is a temporary storage area. It holds the data and instructions that the Central Processing Unit (CPU) needs. Before a program can be run, the program is loaded from some storage medium into the memory. This allows the CPU direct access to the program. Memory is a necessity for any computer.

Because the computer is an electrical device, it understands only **electricity on** and **electricity off**. This is expressed by using two symbols – 0 and 1 – which are called binary digits or bits. Numbers and text characters are represented as codes, which are made up of combinations of 0s and 1s. The character codes are called ASCII (the American Standard Code for Information Interchange). In ASCII, eight bits – any combination of 0s and 1s – form one character or symbol. For example, the letter A is denoted by the code 01000001. The basic working unit of the computer's memory is therefore a group of eight bits, which is called a byte. The computer's memory consists of many thousands of bytes. To make it easier, the unit K (for kilobytes) can be used to express memory capacity. One K equals 1,024. For example, 64K bytes of memory is the same as 65,536 ( $1,024 \times 64 = 65,536$ ) bytes. For larger memory capacities, the units *mega* and *giga* can be used. One megabyte of computer memory usually means 1024 kilobytes, which is 1,048,576 bytes, whereas one gigabyte means 1024 megabytes, which is 1,073,741,824 bytes.

The CPU calls instructions and data from the computer's memory. Because the same computer performs different tasks at different times, the memory is erasable -- much like audio cassette tapes must be erasable to record different musical selections at different times). But there are some programs and instructions which the computer needs. It does not matter what function you are performing. These programs often are permanently recorded in the memory. So they cannot be destroyed. As a result, the computer's memory usually consists of two parts:

## Read only memory (ROM)

This is the permanent memory which is used to store important control programs and systems software to perform a variety of functions, such as booting up or starting up programs. ROM is non-volatile. That means the contents are not lost when the power is switched off. Its contents are permanently written at the time of manufacture.

## Random access memory (RAM)

RAM is used as the working memory of a computer system. It stores input data, intermediate results, programs, and other information temporarily. It can be read and written. It is volatile, that is all data will be erased when the power is turned off.

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# Random access memory

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**Random access memory** (or simply **RAM**) is the memory or information storage in a computer that is used to store running programs and data for the programs. Data (information) in the RAM can be read and written quickly in any order. Normally, the random access memory is in the form of computer chips. Usually, the contents of RAM are accessible faster than other types of information storage but are lost every time the computer is turned off.

## Different types of RAM

There are several types of RAM used in modern computers. Prior to 2002, most computers used single data rate (SDR) RAM. Most computers made since use either double data rate (DDR), DDR2, or DDR3 RAM. DDR2 allows stored data to be moved and used more quickly than DDR, so that the computer's processor can keep working quickly without having to wait for data as long or as often, and DDR3 technology works even faster.

Different kinds of RAM usually will not work together in the same computer. Most computers can only use one kind of RAM. Some can use a small number of different kinds. Different kinds of RAM often have differently shaped connectors so that they can only be connected to computers they will work in.

## Other kinds of memory

Information that the computer always needs, that does not often change, is normally kept in read-only memory (ROM), which does not lose its contents when the computer is turned off. Such items include the BIOS (Basic Input/Output System), which stores the most basic commands for the computer, telling it how it should start up. The BIOS can be compared to the part of your brain that tells your heart how to beat. This is an important part.

# Read-only memory

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**Read-only memory** (or simple **ROM**) is a type of computer memory. Unlike RAM, it keeps its contents even when the computer or device is turned off. Usually, ROM cannot be written to when the computer runs normally. ROM is used for important programs like the BIOS which tells the computer how to start, or the firmware of certain devices, which usually does not need to be modified. Usually, ROM comes on computer chips.

There are different kinds of ROMs:

- **Masked ROM:** This kind is written once, at the factory. It cannot be changed at all later on. Its main benefit is that it is very cheap to make.
  - **PROM:** Can be programmed once. Comes *unprogrammed* from the factory. Programming consists in removing connections. Has been replaced by EPROMs
  - **EPROM:** This kind can be erased with UV light.
  - **EEPROM:** This kind can be erased using an electrical signal. Today, flash memory is often used.
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# Sound card

A **sound card** (**audio card**) is the part of the Computer hardware that controls the input and output of the sound signals. A sound card is what is known as an expansion card. This means that the card can be added to the motherboard.

Nowadays, most of the audio cards are integrated with the motherboard. That means they are build in onto a mainboard and can not be removed. In other words it is not an expansion card anymore. They offer only line-in, speaker, and microphone connections. For most users this is enough. When thinking of computer architecture the integrated circuit sound cards occupy less space and thus became very popular and practical, especially for laptop computers. For more features like MIDI ports for connection of musical instruments and low latency requirements (so that the sound does not come distorted under heavy system usage) sound cards as expansion cards can be used. Modern expansion sound cards use the PCI computer bus standard. Earlier sound cards used the ISA computer bus, which was half-duplex, so the sound cards could not record and play simultaneously.



Creative Sound Blaster Live!, a PCI sound card

## Input and Output signals

What we hear in speakers is an analog (current, voltage or electric charge) output of the signal. For example stored on a hard disk digital code is transferred under a control of some application (for example Winamp) to the sound card. Up in there, a special chip, called digital-to-analog converter, changes the binary code into the analog sound. Afterwards, signal is sent to jack (in modern audio cards it has the green color) where the speakers are connected. The result is a nice waveform of our favorite digital medium, e.g. an mp3.

A typical sound input device is a microphone, connected to the red/pink jack socket. The sound wave is digitized and then it may be stored as a file using data compression algorithms which make the file smaller. Of course all of this is done under the control of some software.

# Video card

In computing, a **video card** (also called a graphics card or a graphics accelerator) is a special circuit board that controls what is shown on a computer monitor and calculates 3D images and graphics.

A video card can handle two types of video images. First, they can be used to display a two-dimensional (2D) image like a Windows desktop, or a three-dimensional (3D) image like a computer game. Computer-Assisted Drawing (CAD) programs are often used by architects and designers to create 3D models on their computers. If a computer has a very fast video card, the architect can create very detailed 3D models.

Many computers have a basic video and graphics capabilities built-in to the computer's motherboard. These "onboard" video chips are not as fast as normal graphics cards. They are fast enough for basic computer use and even some basic computer games. If a computer user wants faster and more detailed graphics, a video card can be installed.

Video cards have their own processor (called a Graphics Processing Unit or GPU). The GPU separate from the main computer processor (called the Central Processing Unit or CPU). The CPU's job is to process all the calculations needed to make the computer function. The GPU's job is to handle 3D graphics calculations so the CPU does not have to. 3D graphics calculations take a lot of CPU power, so having a video card to handle the graphics calculations lets the CPU focus on other things like running computer programs.

Video cards also have their own memory, separate from the main computer memory. It is usually much faster than main computer memory, too. This helps the GPU do its graphics calculations even faster. Most video cards also allow more than one monitor to be plugged in at one time. This lets the computer user use more than one monitor at once. Graphics manufacturers nVidia and ATI have special technologies that allow two identical cards to be linked together in a single computer for much faster performance. nVidia calls their technology SLI and ATI calls their technology CrossFire. Some modern graphics cards can even process physics calculations to create even more realistic-looking 3D worlds.

Video cards typically connect to a motherboard using the Peripheral Component Interconnect (PCI), the Advanced Graphics Port (AGP) or the Peripheral Component Interconnect Express (PCI Express or PCI-E). PCI-E is the newest and fastest connection; most (if not all) new video cards and motherboards have this connection. Before PCI-E was used, AGP was the standard connection for video cards. Before AGP, video cards were designed for PCI (sometimes called "regular" PCI).

## History

In early computing years, graphics processing was very basic and could be done by the CPU along with all the other processing. However, as computer games advanced and started using 3D graphics, the CPU had too much to do and CPU-makers could not keep up on making them faster. Eventually, video cards were invented to solve this problem. Video cards are designed to have their own processor called the Graphics Processing Unit or GPU. This lets the CPU do more work since it does not have to spend any time on advanced graphics calculations; it can simply pass these calculations off to the GPU to be done.

The first video cards connected to the motherboard via the ISA connection. The first popular non-IBM video cards were manufactured by a company called Hercules Computer Technology, Inc. Throughout the years, the importance of video cards has grown. As they evolved, a new connection standard was developed called Advanced Graphics



A Modern video card with the heatsink removed



Port (AGP). This was the first motherboard connection designed exclusively for video cards. It was much faster at transferring information between the video card and the rest of the computer. Eventually, the AGP connection became outdated, and a new connection, called PCI Express (PCI-E), became the standard for video cards. Most video cards manufactured today use PCI-E to connect to the motherboard.

## Network card

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A **network card** is a piece of hardware that permits a computer to participate in a computer network. There are different kinds of networks, such as Ethernet or wireless LAN. The network cards for the different networks are different. Sometimes the network card is integrated on the motherboard. Each network card has a unique number; this is used for addressing. It is called the MAC address. MAC addresses can be used to obtain an IP address (in those network cards that use IP).

## Input/output

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In computing, **input/output**, or **I/O**, refers to the communication between a digital processing system (such as a computer or an embedded system), and the outside world – possibly a human, another processing system or a device.

Inputs are the signals or data received by the system, and outputs are the signals or data sent from it.

I/O devices are used by a person (or other system) to communicate with the digital processing system. For instance, keyboards and mice are considered input devices of a computer, while monitors and printers are considered output devices of a computer. Devices for communication between computers, such as modems and network cards, typically serve for both input and output.

Note that the description of a device as either input or output depends on how it is viewed. Mouses and keyboards take as input physical movement that the human user outputs and convert it into signals that a computer can understand. The output from these devices is input for the computer. Similarly, printers and monitors take as input signals that a computer outputs. They then convert these signals into representations that human users can see or read. (For a human user the process of reading or seeing these representations is receiving input.)

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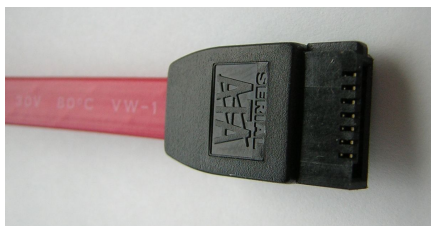
# Hard disk

A **hard disk drive** (HDD) , **hard disk** (sometimes 'disk' is also spelled *disc*) or **hard drive**, is something used by computers to store information. Hard disks use magnets to store information. The capacity of a hard drive is usually measured in gigabytes (GB). A gigabyte is one thousand megabytes and a megabyte is one million bytes, which means that a gigabyte is one billion bytes. Some hard drives are so large that their capacity is measured in terabytes, (TB) where one terabyte is a thousand gigabytes (1 TB = 1000 GB).



Top and bottom views of a Western Digital WD400 3.5" hard disk

## Different interfaces



Serial ATA cables are a common way to connect hard disks

Hard disks use different interfaces and ports. An interface usually has two parts. First there is the specification of how the signals are transmitted. This includes what cables to use, what length the cables can be and so on. The second part of the interface definition is the language to use. This speaks about what the signals mean.

As there are different kinds of hard disks, there are also different kinds of interfaces. In 2009, it was common to attach a hard disk using a Serial ATA connection. The connection that came before that was called "IDE" and is called Parallel ATA today. In large data centers,

Fibre Channel is often used.

For servers, the SCSI (pronounced 'scuzzy') interface is very popular. There are several types and versions of SCSI interface, like parallel and Serial Attached SCSI, each stepping-up in terms of speed and price. Within servers, several SCSI drives are often used in conjunction with each other, in order to safeguard against data loss or corruption (this is known as RAID - and there are many different configurations to choose from).

# Data storage device

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A **Data Storage device** is a storage medium. Most often the term is used with computers. Data storage devices can permanently hold data, like files. Common data storage devices are:

- USB flash drives
- Hard disk drives
- Compact Discs
- DVDs
- HD DVDs
- UMDs
- Blu-ray Discs

## USB flash drive

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A **USB flash drive** is a small device that stores information and files from a computer. Flash drives are an easy way of moving data between different computers or devices to be read or edited. Flash drives are connected to a computer using a USB port, which can be found on many devices. Flash drives take their name from the **flash** memory used to hold files. Flash memory is a type of memory that does not need any moving parts, unlike a CD or Floppy disk.

The capacity of flash drives starts at few megabytes. In April 2010, the ones that could hold most data could hold about 256 gigabytes.

Other common names for a flash drive include: **memory stick**, **keydrive**, **pendrive**, **thumbdrive** and **jumpdrive** or simply **USB**.

USB flash drives have some advantages over other portable storage devices. They are much smaller than floppy disks, and can hold much more data. They do not have moving parts, so they should be more reliable.



## Uses

### As a personal data store/transport

Flash drives are used to store any type of data file, or to move data from one computer to another.

### Holding data for people who manage computers

Administrators, or people who manage the computer systems, sometimes use flash drives. Sometimes flash drives are also used to run a computer virus scanner, or to restart a computer system that broke or was damaged or lost. The drives have a lot of storage space, and it is often easier to carry a flash drive than to carry a number of CD-ROMs.

Some types of flash drive also allow you to install (or download) computer programs. These applications can then be run on any computer without the need for installing them. Very often, they have been changed so that they use computer memory to hold temporary information, for example.

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## Computer forensics and law enforcement

Police in the cyber division can use flash drives to take evidence or proof.

## Audio players

Many companies make small solid-state [digital audio players. These are actually flash drives that can make sound. Examples include the Creative MuVo and the iPod shuffle. Some of these players are real USB flash drives as well as music players; Others just play music.

Many of the smallest players are powered by a permanently fitted rechargeable battery. The battery can be charged from the USB interface.

## Music storage and marketing

Digital audio files can be moved from one computer to another like any other file, and played on a compatible Media player. In addition, many home Hi-Fi and car stereos are now equipped with a USB port. This allows a USB flash drive containing media files in a variety of formats to be played directly on devices which support the format.

Artists have sold or given away USB flash drives, with the first instance believed to be in 2004 when the German band WIZO released the "Stick EP", only as a USB drive. In addition to five high quality MP3s, it also included a video, pictures, lyrics, and guitar tablature.

Subsequently, artists including Kanye West<sup>[1]</sup>, Nine Inch Nails and Ayumi Hamasaki<sup>[2]</sup> have released music and promotional material on USB flash drives.

## In arcades

In the arcade game *In the Groove* and *In The Groove 2*, flash drives are used to transfer high scores, screenshots, dance edits, and combos throughout sessions. In later versions players can also store custom songs and play them on any machine on which this feature is enabled. While use of flash drives is common, the drive must be Linux compatible, causing problems for some players.

In the arcade games *Pump it Up NX2* and *Pump it Up NX Absolute*, a special produced flash drive is used as a "save file" for unlocked songs, as well as progressing in the WorldMax and Brain Shower sections of the game.

In the arcade game *Dance Dance Revolution X*, a special USB flash drive was made by Konami letting players link the Sony PlayStation 2 version

## Brand and product promotion

Flash drives are very cheap to produce. So, they are sometimes used to promote a product. At most technical trade fairs many exhibitors will promote their products by giving away free drives.

In other situations they may be sold at less than wholesale price, or included as a bonus with another product.

Usually, such drives will be stamped with a company's logo, as a form of advertising .

The drive may be blank drive, or already have documents or software loaded on to it. These are called preloaded drives

Some preloaded drives are read-only, but most can be used as a normal flash drive

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Backup

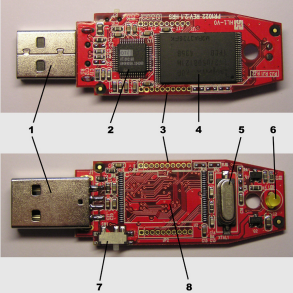
The large memory size of newer flash drives means that they are increasingly being used for short term backup of data. For example, one retail till system uses a Flash drive to record details of all of the sales for that day. The drive is used as a backup medium. At the close of business each night, the drive is inserted, and a database backup is saved to the drive. The drive is removed at night and taken offsite.

- This is simple for the end-user, and more likely to be done;
- The drive is small and convenient, and more likely to be carried off-site for safety;
- The drives are less fragile mechanically and magnetically than tapes;
- The capacity is often large enough for several backup images of critical data;
- Flash drives are cheaper than many other backup systems.

Parts

This photograph shows both sides of the printed circuit board (PCB) inside a typical flash drive (circa 2004). The flash drive in this photograph is a 64 MB USB 2.0 device with its plastic case removed.

One end of the device is fitted with a single type-A USB connector. Inside the plastic casing is a small, highly cost-engineered, printed circuit board. Mounted on this board is some simple power circuitry and a small number of surface-mounted integrated circuits (ICs). Typically, one of these ICs provides an interface to the USB port, another drives the onboard memory, and the other is the flash memory.



**The internal components of a typical flash drive**

1	USB connector
2	USB mass storage controller device
3	Test points
4	Flash memory chip
5	Crystal oscillator
6	LED
7	Write-protect switch
8	Unpopulated space for second flash memory chip

## Good points and bad points

### Pros

Most computers support USB.

Flash drives are quite **robust** <sup>[3]</sup>. They are not damaged by scratches and dust. This makes them a good choice to move data from one place to another.

Some flash drives can keep the data, even if they are put in water.<sup>[4]</sup> Some data may even survive the washing machine, but this is not a designed feature, and people should not rely on it. Leaving the flash drive out to dry completely before allowing current to run through it has been known to result in a working drive with no future problems.

Channel Five's *Gadget Show* cooked a flash drive with propane; froze it with dry ice; submerged it in various acidic liquids; ran over it with a jeep and fired it against a wall with a mortar. A company specializing in recovering lost data from computer drives then managed to recover all the data on the drive.<sup>[5]</sup> All data on the other removable storage devices tested, using optical or magnetic technologies, were destroyed.

Flash drives are available in large sizes. Currently at the start of 2010, the largest size publicly available is 256 gigabytes. This will increase as the technology gets better.

Flash drives use little power, compared to hard drives and have no moving parts. They are small and easy to carry.

Most modern operating systems can use a flash drive, without the need to install special software. To most operating systems, the flash drive looks like a hard drive. The operating system can use any file system. Some computers can start from a flash drive.

### Cons

Flash memory has a limited life. Data can only be written to and read from a device a few thousand times.<sup>[6]</sup> <sup>[7]</sup> People should keep this in mind when they use a flash drive to run application software or an operating system. To address this, as well as space limitations, some developers have produced special versions of operating systems (such as Linux in Live USB) <sup>[8]</sup> or commonplace applications (such as Mozilla Firefox) designed to run from flash drives.

Flash drives are small and are easily lost or left behind. This can cause problems of data security.

### Security issues

Flash drives can hold a large amount of information and they are used worldwide. Many users store information on them that is personal, or that should be protected. For this reason, more and more flash drives offer biometrics or encryption to control the access to this data. Users can install passwords on to their flash drives so that when a user tries to open it, the computer prompts the user, to enter a password before they can begin using the device. There are a number of free and open source programs which can be used to encrypt data including TrueCrypt, pgpdisk and FreeOTFE. These programs have proved useful in securing data on flash drives.

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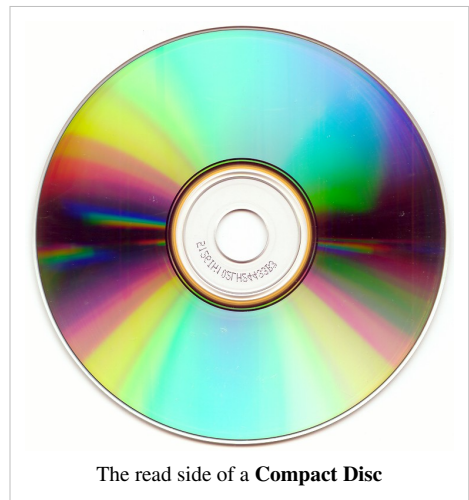
## Compact Disc

A **Compact Disc (CD)** is a type of optical disc. It is flat and round, and is used to store digital data. It is used to store music and other sounds (and sometimes called an "audio CD"). The sounds on the CD are played using a compact disc player. It was developed by Phillips and Sony.

Later, Compact Discs were made that could be used to put computer files on in the same way as audio compact discs. These are called CD-ROMs (Compact Disc Read-Only Memory). The computer 'reads' the disc using a CD-ROM drive. Another use is to store MPEG videos cheaply, these CDs are called VCDs (Video CDs) and are especially popular in Asia. For example, in Indonesia they are used instead of the more expensive DVD.

The diameter of a normal CD is 120 mm. The middle hole in a CD is about the size of a five cent coin (About 1.5 cm). The person who decided the size was Dutch and used the size of an old Dutch coin (old because the Dutch now have switched to the Euro), called a "dubbeltje", or dime. A CD usually holds a maximum of 74-80 minutes of audio or 650-700 megabytes of data.

Some CDs are smaller; they are 80mm in diameter. They can hold about 30% of the capacity of a normal disc.



The read side of a **Compact Disc**

## Other pages

- CD-R
- CD-RW
- Video CD or VCD
- DVD

# Article Sources and Contributors

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